

# [Shutdown separators with improved properties ]

## Abstract

A microporous polyolefin battery separator membrane is extremely high in porosity, high in puncture strength, very low in shrinkage and with shutdown temperature of 130–140 degrees C and melt integrity greater than 165 degrees C. It is made of UHMWPE having a weight-average molecular weight of  $1 \times 10^6$  or more and an inert filler. A second microporous polyolefin battery separator has a shutdown temperature of between 95 and 110 degrees C and a melt integrity of more than 165 degrees C. It is made from an UHMWPE having a weight-average molecular weight of  $1 \times 10^6$  or more, a shutdown (LMWPE) having a weight-average molecular weight of 4500 or less and an inert filler. Both membranes have a thickness of 5–75 microns, a porosity of 30–95%, an air permeability of 1–200 sec/10cc , an average pore diameter of .001 to 1 micron and puncture strength of more than 300 grams/25 $\mu$ m.